

What is claimed is:

1. A method of modeling a directed evolution protocol comprising:
applying equilibrium thermodynamics to a plurality of sequences to determine statistics of hybridization; and
parameterizing an assembly algorithm using the statistics of hybridization.
2. The method of claim 1 further comprising applying the assembly algorithm to reassemble a plurality of sequences.
3. The method of claim 2 further comprising determining crossover allocation in the plurality of reassembled sequences.
4. The method of claim 3 wherein the step of determining crossover allocation includes estimating a fraction of the plurality of reassembled sequences containing a number of crossovers.
5. The method of claim 3 wherein the step of determining crossover allocation includes estimating a probability that a given nucleotide position in one of the plurality of reassembled sequences is a site of a crossover event.
6. The method of claim 1 wherein the directed evolution protocol is DNA shuffling.
7. The method of claim 1 wherein the directed evolution protocol is SCRATCHY.
8. The method of claim 1 further comprising identifying a minimum number of required silent mutations to meet a DNA recombination objective.
9. The method of claim 1 wherein the step of applying equilibrium thermodynamics to determine statistics of hybridization includes:
modeling annealing events during reassembly as a network of reactions;
determining a predicted fraction of fragments that will anneal at a given temperature;

determining a predicted distribution of annealing for overlap lengths; and
determining a portion of annealing events predicted to involve mismatches.

10. The method of claim 1 wherein the assembly algorithm excludes silent crossovers.

11. An isolated nucleic acid molecule comprising:
a nucleotide sequence having an amino acid sequence;
the nucleotide sequence isolated at least in part through a directed evolution experiment;
and
the directed evolution experiment selected at least in part by applying equilibrium
thermodynamics to a plurality of sequences to determine statistics of hybridization
and parameterizing an assembly algorithm using the statistics of hybridization.

12. A vector comprising the nucleic acid molecule of claim 11.

13. A host cell containing the vector of claim 12.

14. A protein encoded by the nucleic acid sequence of claim 11.

15. A system for modeling a directed evolution protocol comprising:
a plurality of sequences; and
an article of software for determining statistics of hybridization of the plurality of
sequences to parameterize an assembly algorithm by applying equilibrium
thermodynamics to the plurality of sequences.